

## 15.0 RESPIRATORY

Last Reviewed: December 13

Last Revised: August 21

### 15.1 ASTHMA

**AEROMEDICAL CONCERNS:** Asthma symptoms can rapidly progress from minimal to totally disabling. Exposure to dust, smoke or fumes can provoke attacks in susceptible individuals. Positive pressure breathing, breathing cold or dry air, and +Gz exposure can stimulate bronchospasm in individuals with hyperreactive airways.

**WAIVER:** Any history of asthma, to include childhood asthma and exercise-induced asthma, is considered disqualifying (CD) for aviation duties and training, even if the disease is very mild.

**APPLICANTS:** Waivers for applicants with a history of asthma may be *considered* if all of the following criteria are met, with complete documentation submitted to Code 53HN:

1. The individual is currently asymptomatic and has been asymptomatic for a minimum of five years without medication use or prescriptions filled.
  - a. Depending on the needs of the Navy, asthma that is symptomatic/requires medication use into adulthood ( $\geq 18$  yo) is generally not considered for waiver in untrained personnel.
2. Baseline pulmonary function testing (PFT) within 1 year of waiver application is normal.
3. Methacholine challenge test within 1 year of waiver application is within normal limits and not suggestive of bronchial hyperresponsiveness.
4. Completed Navy [ARWG Asthma worksheet](#) reviewed with patient and signed by submitting FS/AME. (form follows this section)

A history of inhaler use that is clearly not suggestive of asthma is NCD. **A complete asthma worksheet submitted with the flight physical may be sufficient. Further records, testing, and consultation may be required by NAMI on final review.**

**DESIGNATED PERSONNEL:** Asthma is CD for designated aviation personnel. A history of childhood asthma that was previously waived requires a new waiver should the individual develop recurrent symptoms or require medication. Waivers may be considered based on severity of disease, response to therapy and evidence of adherence to the proper components of care. Moderate and severe asthma not readily controlled with therapy will not be waived. **A Local Board of Flight Surgeons may NOT be used to provide temporary flight clearance for asthma.**

#### INFORMATION REQUIRED:

1. Aeromedical Summary (AMS) addressing the four components of care (below)
  - a. For tobacco users, documentation of smoking cessation is required
2. Family practice (FP), Internal Medicine (IM), or Pulmonology evaluation
3. Results of pulmonary function testing
  - a. NOTE: Spirometry must be within normal limits and without obstruction at time of waiver application.
4. Allergy consult and results of allergen testing (e.g. skin testing, RAST testing) for personnel with persistent asthma in whom AIT may be beneficial (e.g. patients with allergic rhinitis, seasonal asthma, difficult to avoid triggers).

## RENEWAL REQUIREMENTS:

1. AMS addressing the four components and any interval changes
  - a. In prior smokers, documented abstinence is required.
2. FP, IM, or Pulmonology evaluation with comments on stability.
3. Annual PFTs when clinically indicated or directed by waiver requirements.

## Four Components of Asthma Care (AMS should address them all)

1. **Asthma Severity and Control:** The AMS must classify severity using most current asthma guidelines (i.e. intermittent, mild persistent, moderate persistent, or severe persistent) and comment on impairment (frequency of attacks, nighttime symptoms, and functional limitations to daily activities). The AMS should also note the level of control (lifetime history of hospitalizations, number of emergency room and clinic visits related to asthma in the past 12 months, frequency of rescue inhaler usage).
2. **Patient Education:** The AMS must contain comments on patient education about both the asthma and the medications used to control it.
3. **Environmental Factors and Comorbid Conditions:** The AMS should comment on any work or home related stimuli affecting the member's asthma.
4. **Medications:** The AMS should include all medications (including those used "as needed") noting frequency of use of each medication. Records should be reviewed to ensure compliance with required therapy. Evidence of non-compliance may warrant grounding. ***All aviation personnel with asthma must carry a rescue inhaler while flying.***

**DISCUSSION:** The diagnosis of asthma is based primarily on history, with the aid of the physical exam and pulmonary function testing (PFT) demonstrating reversible airway obstruction. Regarding methacholine challenge testing (MCCT), it is currently required for all applicants with a known or questionable history of asthma in order to exclude current bronchial hyperresponsiveness. In designated personnel, bronchoprovocation studies (e.g. MCCT) may not be necessary to establish a diagnosis of asthma, particularly those with classic symptoms or documented reversible airway obstruction. MCCT is most useful in symptomatic patients when asthma is suspected, but spirometry is normal or shows borderline obstruction. In borderline cases, a negative MCCT can help to rule out asthma. In asymptomatic patients, a negative MCCT does not rule out a *remote* history of asthma and/or seasonal asthma. When referring patients with remitted childhood asthma for pulmonary testing, avoid testing in the setting of a recent (within two weeks) respiratory infection to minimize confusion and ensure reliable results are obtained.

When diagnosing and treating asthma in aviation personnel, the FS/AME should reference and be familiar with the **Asthma Guidelines from the National Heart, Lung, and Blood Institute**. Links to applicable documents can be found at the NAMI website.

**Waiverable Medications in Designated Personnel:** Any of these medications may be waived within the context of overall severity and control.

- Short-acting beta agonists -e.g. albuterol, levalbuterol
- Inhaled corticosteroids (ICS) e.g. fluticasone, budesonide
- Long-acting beta agonists (when combined with ICS) –e.g. salmeterol, formoterol
- Leukotriene Receptor Antagonists –e.g. montelukast

Personnel requiring immunomodulators (omalizumab), methylxanthines (theophylline) or systemic corticosteroids for control are NPQ with no waiver recommended.

**ICD-9 CODES:**

**493.0 Extrinsic Asthma**

**493.1 Intrinsic Asthma**

**493.9 Asthma, Unspecified (use for Exercise Induced Asthma)**

## 15.2 CHRONIC OBSTRUCTIVE PULMONARY DISEASE

**AEROMEDICAL CONCERNS:** Chronic obstructive pulmonary disease (COPD) results in a reduction in maximum oxygen uptake and exercise tolerance. Cerebral hypoxia can adversely affect psychomotor skills, memory, judgment and cognition. Decrements in judgment and the ability to perform complex tasks are also caused by carbon dioxide retention that can occur in COPD. Sudden incapacitation as a result of pneumothorax can occur if a bulla ruptures.

**WAIVER:** Waivers will not be considered in Applicants. COPD is CD for class I and II. Per MANMED, mild COPD is NCD for class III, whereas moderate to severe COPD requires a waiver. A waiver is highly unlikely for class I and II, but may be considered for designated personnel on a case-by-case basis if there is no cardiovascular decompensation, exercise tolerance is unimpaired, and there are no bullae evident on CT. Aviation personnel meeting these criteria will be restricted from high-performance aircraft.

### INFORMATION REQUIRED:

1. Internal medicine or pulmonology consultation
2. High-resolution CT of the chest
3. Complete PFT including pre- and post- bronchodilator
4. Resting oxygen saturations/ABGs
5. Echocardiogram
6. Documentation of smoking cessation

**NOTE:** Moderate-Severe COPD should be referred to a medical board

**TREATMENT:** Short-acting bronchodilators and long-acting bronchodilators, anti-muscarinics or beta agonists, either alone or in combination with inhaled corticosteroids, will be considered on a case-by-case basis depending on flying class, symptom control, and disease severity. Vaccination against pneumococcus, annual influenza immunization, and treatment aimed at weight loss (if overweight) are encouraged. **Smoking cessation is required.**

**DISCUSSION:** The lower limit of oxygenation needed to permit adequate cerebral oxygenation is a  $PaO_2 > 65$  mm Hg at sea level. The corresponding lower limits for successive 1000 ft increments to 8000 ft are 61, 58, 55, 52, 50, 48, 46 and 45 mm Hg. Obesity or tight fitting clothing can reduce lung volumes leading to hypoventilation and ventilation/perfusion imbalance. Patients with COPD are also at increased risk of acute chest infections, further complicating care in the operational setting. Symptoms will be expected when the forced expiratory volume at 1 second (FEV1) reaches 50% of that predicted by sex and age. While the normal FEV1 declines at about 30 ml/year, the reduction in smokers can reach 90 ml/year. Of all patients, up to 50% will have persistent, productive cough, up to 25% will be moderately disabled with recurrent chest infections and increasing absences from work, and up to 25% will be severely disabled within 10 years.

### ICD-9 CODE:

**496 Chronic Obstructive Pulmonary Disease**

## 15.3 PNEUMOTHORAX

**AEROMEDICAL CONCERNS:** Acute pneumothorax may cause acute chest pain and dyspnea during flight, worsening as ambient pressure falls. Tension pneumothorax is a life threatening condition that, although rare, will cause hypoxia arising from ventilation/perfusion imbalance and cardiovascular compromise.

### WAIVER:

**Traumatic Pneumothorax:** Traumatic or surgical pneumothorax during the preceding year is CD. Waivers are considered on a case by case basis during the first year following the injury after complete healing and when the member is determined to be fit for full duty by the pulmonologist or surgeon.

**Spontaneous Pneumothorax:** Primary spontaneous pneumothorax is CD. A waiver can be considered based upon the guidelines below. A subsequent occurrence of spontaneous pneumothorax is CD. No waiver will be recommended unless surgical or chemical pleurodesis has been performed.

### Applicants:

- **Single episode of spontaneous pneumothorax:** The applicant may be considered for waiver of standards one year after the resolution of the pneumothorax if treated solely with chest tube reinflation. High resolution CT scan must prove no pathology (blebs or underlying parenchymal disease) and pulmonary function tests must be within normal limits. If treated surgically or chemically, a waiver may be considered six months following resolution, provided the required studies are normal. All applicants must first be granted a waiver for commissioning before an aviation waiver can be considered. The commissioning waiver document must be submitted to NAMI with the aviation waiver request. Altitude chamber runs are not required for disposition and/or waiver recommendation.
- **Recurrent spontaneous pneumothorax:** Permanently disqualifying. No waivers will be recommended unless chemical or surgical pleurodesis has been performed resulting in a normal high-resolution chest CT scan and normal Pulmonary Function Testing (PFT).

### Designated:

- **Single episode of spontaneous pneumothorax:** A waiver request may be submitted three months after resolution of the condition. The submission must include the required information. For designated personnel who undergo chemical or surgical pleurodesis, a waiver request may be submitted three months after resolution of the condition. An altitude chamber run is not required for disposition and/or waiver recommendation.
- **Recurrent spontaneous pneumothorax:** CD, waiver not recommended. Waivers may be considered only after definitive treatment (chemical or surgical pleurodesis) to prevent recurrence. Designated personnel who undergo chemical or surgical pleurodesis may be returned to flying status after three months

**INFORMATION REQUIRED:**

1. Thin cut, high-resolution chest CT scan demonstrating full lung expansion and no pathology that could predispose to recurrence
2. Normal Pulmonary Function Test results
3. Thoracic surgery consultation (in recurrent cases, or in cases with structural abnormalities)

**FOLLOWUP:** None required.

**TREATMENT:** All recognized forms of treatment (chemical or surgical pleurodesis) are acceptable for waiver consideration. Recurrence rate after chemical pleurodesis is higher than after thoracotomy and pleural abrasion.

**DISCUSSION:** Over 90% of patients presenting with spontaneous pneumothorax are under 40 years old, with 75% being younger than 25. In women, there is often a relationship to menstruation. Onset of spontaneous pneumothorax is accompanied by chest pain in 90% of cases and by dyspnea in 89%. Tension pneumothorax develops in 5% and hemopneumothorax in 2.5%. Recurrence rates in patients who have not had definitive treatment have been reported to be from 28% for PSP and 43% for SSP. In one series of patients followed for 10 years without surgery, ipsilateral recurrence followed in 50% of the patients, with 62% happening in the first 2 years. A study published in JAMA 1990 found that most recurrences occur within the first six months. Another study reported a recurrence rate of 30% after a first spontaneous pneumothorax, 50% after a second episode, and 80% after a third. The contralateral risk was reported as 5.2% to 14.6%. Recurrence depends on the procedure used for treatment. Thoracoscopic pleurodesis has recurrence rates less than 7% while chemical pleurodesis has been reported to have a recurrence rate of 9% to 12% depending on the agent used. Thoracotomy with pleural abrasion has rates ranging from 1 to 3.6%. The U.S. Air Force has reviewed patients exposed to chamber flight before return to flying duties. Their analysis revealed that no episodes were eliminated and there was no value in predicting later recurrence. Of note, they required a much longer grounding period before testing, so their data may not be directly comparable to our requirements.

**ICD-9 CODES:**

**512.8 Pneumothorax**

**860 Any Traumatic or Iatrogenic pneumothorax**

## 15.4 SARCOIDOSIS

**AEROMEDICAL CONCERNS:** The protean manifestations of sarcoidosis can involve almost any organ system. Cardiac sarcoidosis, while uncommon, is associated with a restrictive cardiomyopathy and sudden death from arrhythmias. Patients with pulmonary infiltration may have symptoms of restrictive lung disease, which may be distracting in flight. Uveitis can cause permanent visual damage. Nervous system involvement can also occur. Hypercalcemia can predispose the aircrew member to renal stones.

### **WAIVER:**

**Applicants:** CD, waiver not recommended.

**Designated personnel:** CD, waiver considered on case-by-case basis with depending on stage, clinical presentation, and flying class/platform. Contact NAMI Internal Medicine for guidance.

### **INFORMATION REQUIRED (minimum):**

1. Pulmonary or Internal Medicine consult
2. Ophthalmology consult
3. CXR and chest CT with IV Contrast
4. Pulmonary function tests
  - a. Spirometry
  - b. Lung volume
  - c. Diffusion
5. Serum calcium
6. 24hr urine calcium
7. ECG
8. 24 hour holter monitor

**FOLLOW-UP:** Annual submission required with monitoring requirements at a minimum:

1. Chest X-ray
2. PFT's
3. ECG
4. Serum calcium
5. Eye exam

**DISCUSSION:** The incidence is highest in the 20-35 age group. Up to 50% present with abnormal radiographic findings (usually bilateral enlargement of hilar nodes) or nonspecific respiratory symptoms. Between 10 and 50% will have erythema nodosum, which is more commonly seen in females. Uveitis can be seen in 15 to 25% of patients, and superficial node enlargement is seen in about 30% of Europeans with sarcoidosis and up to 80% of African Americans. The spleen is palpable in 10 to 25% of patients, with massive splenomegaly present in 3%. Up to 30% of cases with acute sarcoidosis will have abnormal thallium scans suggesting myocardial involvement. Liver biopsy will show sarcoid granulomas in 70% of cases without evidence of altered liver function. Nervous system involvement is demonstrable in 10% but may be subclinical in a greater percentage. Osteolytic or osteosclerotic bone lesions are also present in 10% of cases. Most cases (80%) with hilar adenopathy resolve spontaneously

within 2 years, but there is a 5-10% chance of developing progressive pulmonary fibrosis and a 6-7% eventual mortality in those with radiologically evident pulmonary sarcoidosis. The presence of ocular involvement or chronic tonsillitis has been reported to be associated with a poorer prognosis. High levels of serum interferon-gamma (IFNg) before treatment are associated with a more favorable prognosis. Healed myocardial granulomas may lead to arrhythmias, and patients in remission who have had myocardial involvement remain at risk for sudden death. MRI scan may eventually prove to be the method of choice for identifying cardiac sarcoid granulomas.

**ICD-9 CODE:**  
**135 Sarcoidosis**



# **COVID-19 Return to Flight Duty Status Guideline for Aerospace Medicine**

**Navy Medicine**

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**28 JULY 2021**



# Aerospace Medicine Sub-Community Contributors

The following individuals are subject matter experts from across the Navy Medicine Enterprise that contributed to the development of the return to flight duty status protocols. These individuals represent a variety of clinical backgrounds and military experiences relevant to the delivery of Aerospace Medicine.

## Contributors – BUMED Return to Flight Duty Status Protocols

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The **Operational Medicine Clinical Community** (OpMed CC) mission is to foster collaboration and knowledge sharing across Naval Medicine to implement leading practices that improve medical readiness, while also supporting operational clinicians and staff in delivering the highest quality care to all Active Duty Sailors and Marines.

The **Aerospace Medicine Sub-Community** (SC), under the Navy's OpMed CC, has the goal of “supporting aerospace medicine [and safety] clinicians and staff through the promotion of best practices” and an objective to “decrease variation and increase standardization in the delivery of patient care in operational environments.” The Aerospace Medicine SC responded to the COVID-19 pandemic by generating the protocols contained in this document. **These protocols reflect official Department of the Navy policy (ALNAV 096/20)** in this format and are the best recommendations at this time from BUMED for returning service members to Flight Duty Status.





# Return to Flight Duty Status Protocols

Aerospace Medicine Providers shall evaluate service members (SMs) who are in a flight duty status to return them to an “Up” flight status after close contact or contracting **Coronavirus Disease 2019 (COVID-19)**. The following protocols are adaptable to clinical and operational settings and developed in support of aviation safety.

**Readiness Tenet:** Personnel in a special duty flight status work in an occupational environment that requires optimal respiratory function and maximum physiological margin to safely operate aircraft and support the Naval Aviation Enterprise mission.

- ✦ These protocols were developed in response to Navy and Marine Corps Aerospace Medicine COVID-19 cases and are promulgated to synchronize the community’s approach to medical evaluation when returning aircrew to flight duty status. Protocols are reviewed biweekly to incorporate updated national guidelines and current published research.
- ✦ The return to flight duty status or “Up” flight status protocols apply to **Class I&II** flight duty status service members (SMs). Class I&II SMs are those who are aircrew in Navy and Marine Corps aircraft.<sup>1</sup> Protocols vary by, close contact, testing, duration, and hospitalized.
- ✦ **Class III&IV** SMs may return to an “Up” flight status when they meet standard Naval criteria for return to work found in the most current NAVADMIN or MARADMIN on COVID-19 Standardized Operational Guidance.<sup>2</sup>
- ✦ In cases where a SM was hospitalized for administrative or other non-clinically indicated reasons, providers should follow the non-hospitalized variation of the protocols.

**NOTE TO FLIGHT MEDICINE PROVIDERS:** The following protocols provide a basic framework and should not substitute for sound clinical judgement. Additional work-up, testing and specialty consult may be required on a case-by-case basis to return aircrew safely to an “Up” flight status. Providers should have a low threshold for testing and specialty consultation.

<sup>1</sup> Manual of the Medical Department, NAVMED P-117, Chapter 15, Article 15-63.

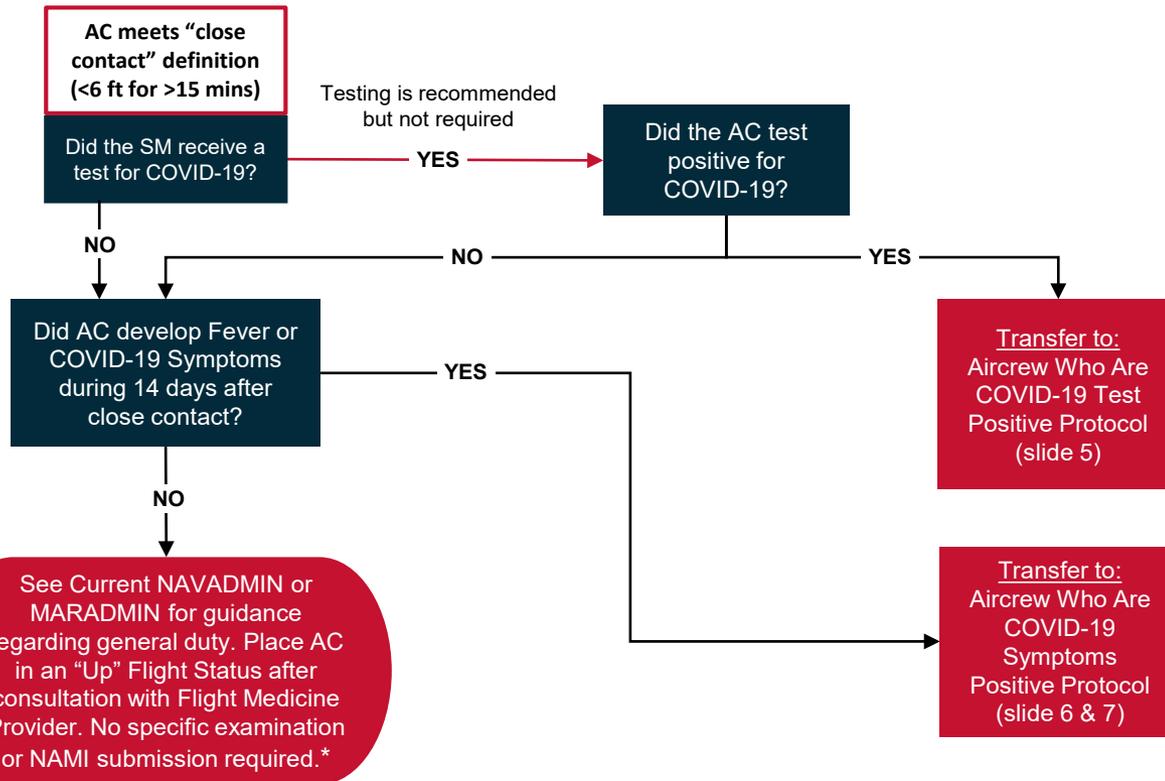
<sup>2</sup> <https://www.public.navy.mil/bupers-npc/reference/messages/NAVADMIN/Pages/NAVADMIN2020.aspx> or <https://www.marines.mil/News/Messages/MARADMIN.aspx>





# Aircrew Who Are COVID-19 Close Contacts

Aircrew (AC) who meet the definition of a **close contact**<sup>1,2</sup> to a confirmed or probable case of COVID-19 should see their Aerospace Medicine Provider and be evaluated and dispositioned based on the following protocol. AC are **exempt** (quarantine and repeat testing is not recommended) from being a “close contact” for 90 days from symptom onset and have recovered from COVID-19.<sup>3,4</sup>



## Legend

- Questions / Decisions
- Actions
- Duty Dispositions

**\*NOTE TO FLIGHT MEDICINE PROVIDERS:**  
Aircrew considered a “Close Contact” must meet all requirements of the most current NAVADMIN or MARADMIN to return to general duty. AC may then return to work in a “Down” status for non-flying duties until seen by a Flight Medicine Provider to verify they remained asymptomatic after being determined a close contact.<sup>1,2</sup>

<sup>1</sup> Centers for Disease Control and Prevention, Public Health Guidance for Community-Related Exposure, 01 March 2021: <https://www.cdc.gov/coronavirus/2019-ncov/php/public-health-recommendations.html>

<sup>2</sup> <https://www.public.navy.mil/bupers-npc/reference/messages/NAVADMINS/Pages/NAVADMIN2020.aspx> or <https://www.marines.mil/News/Messages/MARADMINS.aspx>

<sup>3</sup> Centers for Disease Control and Prevention, Duration of Isolation and Precautions for Adults with COVID-19, 13 February 2021: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/duration-isolation.html>

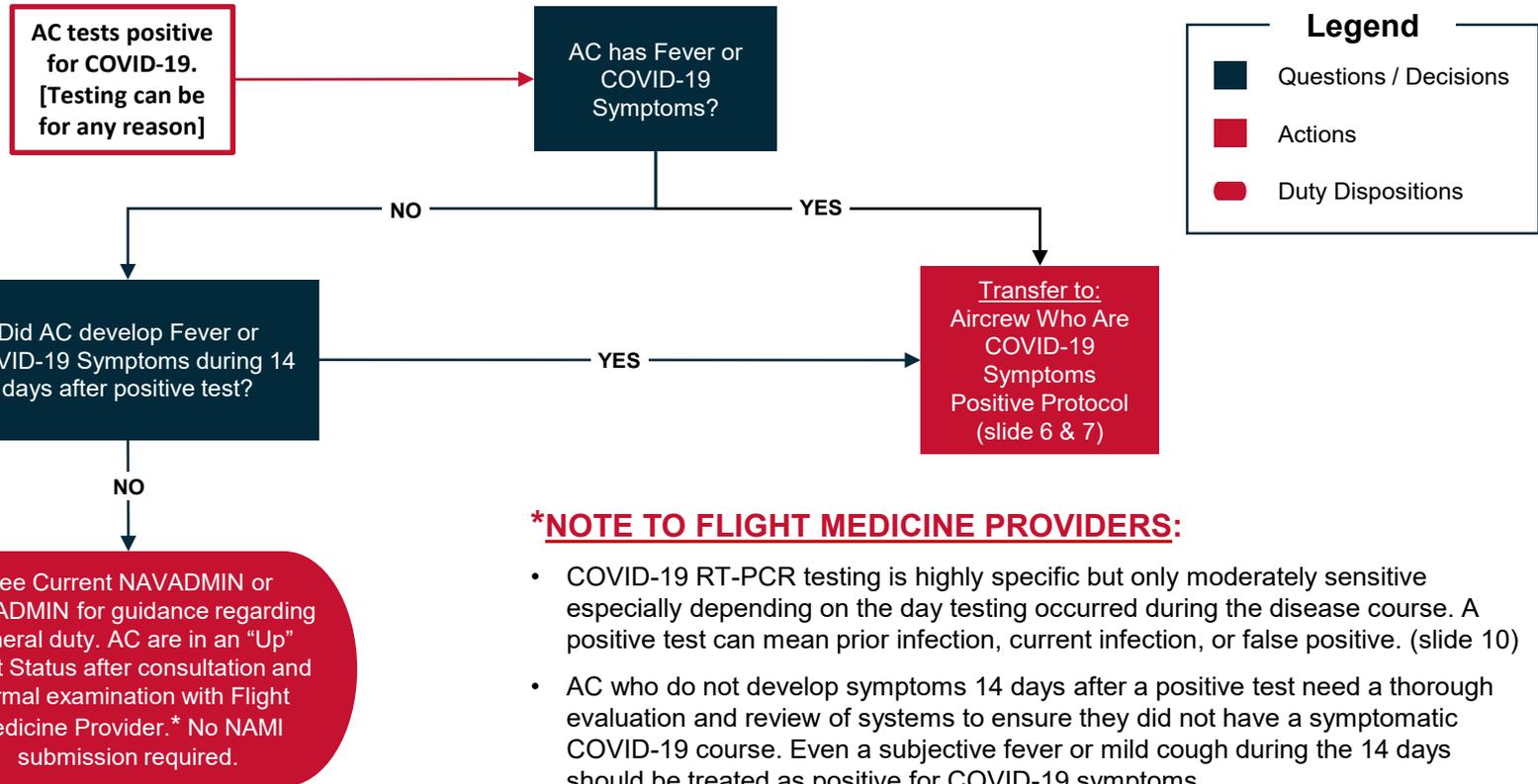
<sup>4</sup> Centers for Disease Control and Prevention, When You Can be Around Others After You Had or Likely Had COVID-19, 29 July 2021: <https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/end-home-isolation.html>





# Aircrew Who Are COVID-19 Test Positive

Aircrew (AC) tested for COVID-19 for any reason and resulted in a positive test should see their Flight Medicine provider and be evaluated and dispositioned based on the following protocol. See reference slide 9 for clinical criteria for diagnosis and slide 10 for confirmatory laboratory evidence. AC are exempt from required testing protocols for 90 days from symptom onset and have recovered from COVID-19.<sup>1,2</sup>



<sup>1</sup> Centers for Disease Control and Prevention, Duration of Isolation and Precautions for Adults with COVID-19, 13 February 2021 : <https://www.cdc.gov/coronavirus/2019-nCoV/hcp/duration-isolation.html>

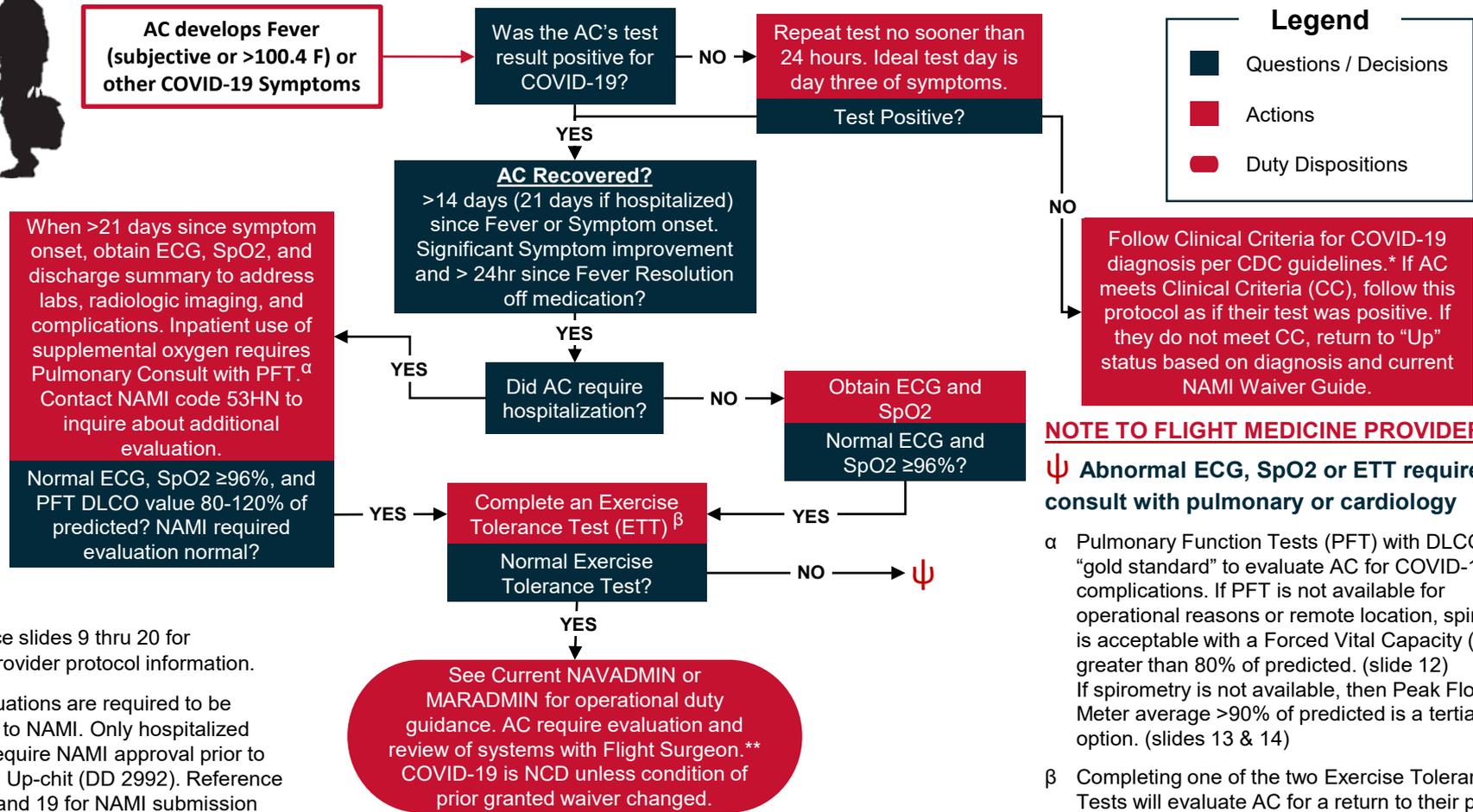
<sup>2</sup> <https://www.public.navy.mil/bupers-npc/reference/messages/NAVADMINS/Pages/NAVADMIN2020.aspx> or <https://www.marines.mil/News/Messages/MARADMINS.aspx>





# Aircrew Who Are COVID-19 Symptoms Positive

This protocol is for all **Fixed Wing (non-TACAIR)** and **Helicopter** Aircrew (AC) who develop symptoms consistent with COVID-19. AC are in a “Down” flight status and shall see a Flight Medicine Provider post recovery for evaluation based on the following protocol. **Recovery** is at 14 days from fever or symptom onset and there has been significant symptom improvement with at least 24 hours since fever resolution. \*



\*Reference slides 9 thru 20 for medical provider protocol information.

\*\*All evaluations are required to be submitted to NAMI. Only hospitalized patients require NAMI approval prior to issuing an Up-chit (DD 2992). Reference slides 18 and 19 for NAMI submission guidance.







# Aviation Medicine Provider Reference Information



# Reference: Clinical Criteria for Case Definition

“A surveillance case definition is a set of uniform criteria used to define a disease for public health surveillance. Surveillance case definitions enable public health officials to classify and count cases consistently across reporting jurisdictions. Surveillance case definitions are not intended to be used by healthcare providers for making a clinical diagnosis or determining how to meet an individual patient’s health needs.”<sup>1</sup>

**Use the Clinical Criteria for guidance, not as an alternative to clinical judgement**

## **Clinical Criteria:**<sup>1, 2</sup>

At least **two** of the following symptoms: fever (**measured or subjective**), chills, rigors, myalgia, headache, sore throat, nausea or vomiting, diarrhea, fatigue, congestion or runny nose.

**OR**

At least **one** of the following symptoms: cough, shortness of breath, difficulty breathing, **new** olfactory disorder, or **new** taste disorder.

**OR**

Severe respiratory illness with at least **one** of the following:

✈️ Clinical or radiographic evidence of pneumonia.

**OR**

✈️ Acute respiratory distress syndrome (ARDS).

**Note:** Anosmia, hyposmia, and dysgeusia are common SARS-CoV-2 symptoms and infection should be strongly considered in patients without other respiratory disease, even without other symptoms.<sup>1,3</sup>

**If initial symptoms occurred during a flight or experienced in the flight environment, follow the Physiological Episodes CPG but consider COVID-19 in differential diagnosis**

<sup>1</sup> THE COUNCIL OF STATE AND TERRITORIAL EPIDEMIOLOGIST(CSTE) CRITERIA FOR A PROBABLE COVID-19 CASE:

<https://www.cdc.gov/nndss/conditions/coronavirus-disease-2019-covid-19/case-definition/2020/08/05/>

<sup>2</sup> Infectious Diseases Society of America Guidelines on the Diagnosis of COVID-19 <https://www.idsociety.org/practice-guideline/covid-19-guideline-diagnostics/>

<sup>3</sup> American Academy of Otolaryngology – Head and Neck Surgery. Coronavirus Disease 2019: Resources, Anosmia, Hyposmia, and Dysgeusia Symptoms of Coronavirus Disease. Mar 2020.





# Reference: Laboratory Criteria

Laboratory evidence should be obtained by using a method approved or authorized by the U.S. Food and Drug Administration or designated authority.<sup>1</sup> Available test types will vary location to location and therefore so will the sensitivity and specificity.

## Confirmatory Laboratory Evidence:

Detection of severe acute respiratory syndrome coronavirus 2 ribonucleic acid (SARS-CoV-2 RNA) in a clinical specimen using a molecular amplification detection test.

Common test type available is the real-time Reverse Transcription Polymerase Chain Reaction (RT-PCR) and specimens are obtained either by nasopharyngeal or oropharyngeal swab.

**Nasopharyngeal is preferred as it is more sensitive <sup>2</sup>**

**Negative tests cannot rule out COVID-19 with clinical suspicion:** Meta-analysis of testing false negative rate shows decreases from 100% on day 1 post-exposure to low of 20% on day 8 (on average symptom day 3) followed by an increase to 66% on day 21. The best day to obtain the lowest chance of a false negative test is day three of fever/symptoms or alternatively day eight in close contact cases. Therefore, RT-PCR testing has limited ability to rule out COVID-19 on the basis of a single point-in-time upper respiratory tract sample.<sup>2</sup> Overall false negative rate for COVID testing is thought to be around 30%. This may vary from lab to lab, and depends on technique with nasopharyngeal swabs. High pre-test probability patients based on clinical presentation should be in isolation and have repeat testing even if testing is initially negative.<sup>3</sup>

**Positive test result after conclusion of disease course:** If a SM tests positive by PCR test within 90 days after having concluded their disease course, it is **not** indicative of infectivity and a reset or new 14 day restriction of movement is not required or advantageous.

Testing for Fleet screening or host country protocol will be determined by those agents

<sup>1</sup> THE COUNCIL OF STATE AND TERRITORIAL EPIDEMIOLOGIST(CSTE) CRITERIA FOR A PROBABLE COVID-19 CASE:

<https://www.cdc.gov/nndss/conditions/coronavirus-2019-covid-19/case-definition/2020/>

<sup>2</sup> American College of Physicians: COVID-19: An ACP Physician's Guide + Resources. 8 June 2020.

<sup>3</sup> Evergreen Health Lessons Learned: COVID-19 <https://www.evergreenhealth.com/covid-19-lessons>





## Reference: Medical Evaluation and ECG

COVID-19 test or symptoms positive Aircrew can return to squadron spaces based on the most current NAVADMIN or MARADMIN general duty return to work guidance but will remain in a “Down” status until Flight Medicine Provider clearance. A comprehensive medical evaluation and review of systems is required and should be documented in the medical record and the Aeromedical Electronic Resource Office (AERO).

### Medical Evaluation:

Complete medical evaluation to include at a minimum, assessment of fatigue, anorexia, headaches, anosmia, and cardiac, ENT, neurologic, and respiratory exams.<sup>1</sup> Address all medications and prior waivers granted. ECG changes or any cardiac symptoms (arrhythmia, angina, prolonged QT interval, limited exercise tolerance) will require cardiology consult. PFT changes or any respiratory symptoms ( $SpO_2 \leq 95\%$ , shortness of breath, limited exercise tolerance, etc.) will require pulmonology consult. Severity of course is marked by symptoms not improving in less than 7 days as this marks the usual onset of dyspnea and cytokine storm.<sup>2</sup>

Evaluations must be done face-to-face and may not be done via telehealth

### Electrocardiogram (ECG):

ECGs to be performed based on recommendations from the American College of Cardiology in physically active populations with symptomatic COVID-19. ECG findings that may indicate myocardial injury include pathological Q waves, ST segment depressions, (new) diffuse ST segment elevation, and T wave inversions that are outside of the normal parameters.<sup>3</sup> If treatment included hydroxychloroquine, a **manually** calculated QT interval is required. Automated QT intervals are based on the Bazett formula and can overestimate the QT interval, especially at elevated heart rates.<sup>4,5</sup> Recommend using Hodges formula for manual calculation.<sup>5</sup>

On-line calculator is located here: <https://www.mdcalc.com/corrected-qt-interval-qtc>

<sup>1</sup> American College of Physicians: COVID-19: An ACP Physician's Guide + Resources. 20 May 2020.

<sup>2</sup> UpToDate, Coronavirus disease 2019 (COVID-19): Clinical features: <https://www.uptodate.com/contents/coronavirus-disease-2019-covid-19-clinical-features>

<sup>3</sup> A Game Plan for the Resumption of Sport and Exercise After COVID-19 Infection. <https://jamanetwork.com/journals/jamacardiology/fullarticle/2766124>

<sup>4</sup> QT Interval Measurement: Evaluation of Automatic QTc Measurement and New Simple Method to Calculate and Interpret Corrected QT Interval Anesthesiology. 2006;104(2):255-260.

<sup>5</sup> Patel PJ, Borovskiy Y, Killian A, et al. Optimal QT interval correction formula in sinus tachycardia for identifying cardiovascular and mortality risk: Findings from the Penn Atrial Fibrillation Free study. *Heart Rhythm*. 2016;13(2):527-535. doi:10.1016/j.hrthm.2015.11.008





# Reference: Pulmonary Function Tests

Hospitalized and TACAIR Aircrew that are COVID-19 symptoms positive require functional evaluation of ventilation and pulmonary physiological margin to support safe return to the flight environment. Further specialist evaluation will be required on a case-by-case basis.

## Pulmonary Function Tests (PFT):

Optimum respiratory system function is essential in aviation. COVID-19 patients can show diffuse alveolar damage on postmortem histopathology in patients with radiographic bilateral ground-glass opacities.<sup>1</sup> PFT is the gold standard in evaluating alveolar injury compared to spirometry because spirometry can be normal with early or mild disease while PFT will still show **low DLCO**.<sup>2</sup> A normal PFT DLCO value is 80-120% of predicted.<sup>2</sup>

On large deck ships (CVN/LHD/LHA), in remote locations, or for operational expediency, physicians may use spirometry when PFT is not available in conjunction with an **exercise tolerance test**. Spirometry **FVC will be considered abnormal below 80%** of predicted instead of 70% considering this is the normal cut off for 18 years of age and Naval Aviators require optimal pulmonary performance.<sup>2</sup> If spirometry FVC is below 80% of predicted, pulmonary consult is required to evaluate sequela from COVID-19.

## Normal and Restrictive Pattern PFT with Low DLCO Differential Diagnosis:

**Low DLCO with Restriction:** Asbestosis, berylliosis, hypersensitivity pneumonitis, idiopathic pulmonary fibrosis, Langerhans cell histiocytosis, lymphangitic spread of tumor, miliary tuberculosis, sarcoidosis, silicosis (late).

**Low DLCO with Normal PFT:** pulmonary emboli, congestive heart failure, connective tissue disease with pulmonary involvement, dermatomyositis/polymyositis, inflammatory bowel disease, interstitial lung disease (early), primary pulmonary hypertension, rheumatoid arthritis, systemic lupus erythematosus, systemic sclerosis, Wegener granulomatosis.<sup>2</sup>

<sup>1</sup> American College of Physicians: COVID-19: An ACP Physician's Guide + Resources. 20 May 2020.

<sup>2</sup> Johnson JD, Theurer WM. A stepwise approach to the interpretation of pulmonary function tests. *Am Fam Physician*. 2014;89(5):359-3





# Reference: Peak Flow Meter Screening

A Peak Flow Meter measures how well your lungs are able to expel air in liters per minute (L/min). This is also known as the peak expiratory flow rate (PEFR) during forced expiration.<sup>1</sup> Use Peak Flow Meter Screening as a tertiary option for pulmonary screening when PFT and spirometry are not available or as an adjunct to your clinical evaluation. For a Predicted Average Peak Flow Table see slide 14.

**Peak Expiratory Flow Rate Screening Protocol:** Three forced exhalations are measured and then an average is calculated. The average PEFR is compared against a predicted PEFR based on age, height, and gender.<sup>2</sup> Online calculator to determine the predicted PEFR can be found here: <https://www.thecalculator.co/health/Peak-Flow-Calculator-617.html>. If the average PEFR is less than 90% of the predicted value then the test is positive for abnormal pulmonary function and a PFT or spirometry is indicated based on availability. Repeating the PEFR screening in a week is also an option. If the average PEFR is greater than 90% of the predicted value then the test is normal and the service member is able to proceed with the exercise tolerance test.



<sup>1</sup> Wright B M. A miniature Wright peak-flow meter. Br Med J 1978; 2 :1627.

<sup>2</sup> Nunn AJ, Gregg I. New regression equations for predicting peak expiratory flow in adults. BMJ. 1989;298(6680):1068-1070. 8 and see slide 14





## Reference: Predicted Average Peak Flow Table

The table below provides predicted Peak Flow rates (L/min) by age and height for both males and females. Use this value when comparing average measured peak expiratory flow rate (PEFR) during forced expiration.

AGE	55"	60"	65"	70"	75"	80"
20	390	423/554	460/602	496/649	529/693	740
25	385	418/543	454/590	490/636	523/679	725
30	380	413/532	448/577	483/622	516/664	710
35	375	408/521	442/565	476/609	509/651	695
40	370	402/509	436/552	470/596	502/636	680
45	365	397/498	430/540	464/583	495/622	665
50	360	391/486	424/527	457/569	488/607	649
55	355	386/475	418/515	451/556	482/593	634
60	350	380/463	412/502	445/542	475/578	618

**Red Font Color**  
= Female  
**Blue Font Color**  
= Male

Leiner GC, Abramowitz S, Small MJ, Stenby VB, Lewis WA. Expiratory Peak Flow Rate. Standard Values For Normal Subjects. Use As A Clinical Test Of Ventilatory Function. Am Rev Respir Dis. 1963 Nov;88:644-651.





# Reference: Exercise Tolerance Tests

Aircrew (AC) require physical fitness that ensures optimum physiological margin in the flight environment. After a COVID-19 course of any duration, exercise tolerance can be reduced. Completing an exercise tolerance test will evaluate AC for a return to their physical fitness level. This test requires a treadmill that will incline to at least a 14% grade.

## Treadmill Exercise Tolerance Test (ETT) with Monitored SpO<sub>2</sub> and Heart Rate:

Test is performed to evaluate if AC have returned to a normal level of exercise tolerance after recovery from COVID-19. Normal tolerance is determined by having AC complete three minute stages at different volume oxygen consumption levels per minute to >10 METs (1 MET equivalent to 3.5 mL O<sub>2</sub>/kg/min of body weight) on Bruce Protocol (table). Test resting SpO<sub>2</sub> before starting test. If less than or equal to 95%, then do not proceed, evaluate patient for pulmonary pathology/abnormalities. SpO<sub>2</sub> monitored while AC are performing each stage will screen for normal oxygenation. SpO<sub>2</sub> is expected to stay >95% and steady during testing.<sup>1</sup> Before completing stage three, AC should also have reached greater than 85% of predicted heart rate ((220 – age) x 0.85). Completing >10 METS on Bruce Protocol is associated with a low risk of death.<sup>2,3</sup>

Stage	Miles per Hour	Grade %	Metabolic Equivalents
1	1.7	10	4.5
2	2.5	12	7
3	3.4	14	10
4	4.2	16	13

**Monitoring with ECG is optimal but not required if not available at local NMRTC**

<sup>1</sup> Bruce, Robert A., et al. "Normal respiratory and circulatory pathways of adaptation in exercise." The Journal of clinical investigation 28.6 (1949): 1423-1430.

<sup>2</sup> Fine (2013) Mayo Clin Proc 88(12): 1408-19 [PubMed]

<sup>3</sup> Myers (2002) N Engl J Med 346(11): 793-801 [PubMed]

<sup>4</sup> UpToDate, Exercise ECG Testing: Performing the test and interpreting the ECG results, Types of Exercise, Bruce protocol; <https://www.uptodate.com/contents/exercise-ecg-testing-performing-the-test-and-interpreting-the-ecg-results>





## Reference: Exercise Tolerance Tests

Aircrew (AC) require physical fitness that ensures optimum physiological margin in the flight environment. After a COVID-19 disease course of any duration, exercise tolerance can be reduced. Completing an exercise tolerance test will evaluate AC for a return to their physical fitness level. If no treadmill is available or available treadmill does not incline to required grade (14%) then a variation of the Exercise Tolerance Test while monitoring SpO<sub>2</sub> and heart rate is a option.

### **Modified Exercise Tolerance Test (ETT) with Monitored SpO<sub>2</sub> and Heart Rate:**

Test is performed to evaluate if AC have returned to a normal level of exercise tolerance after recovery from COVID-19. Normal tolerance is determined by having AC exercise by a variety of options at a moderate level for at least 10 minutes. SpO<sub>2</sub> alone is unable to measure ventilation but is a noninvasive method of assessing oxygenation. SpO<sub>2</sub> and heart rate monitored while AC are moderately exercising for 10 minutes will screen for functional decline in respiratory function.

#### **Modified Exercise Tolerance Test Protocol**

- 1.** Initially screen SpO<sub>2</sub> and heart rate (HR) at rest (sitting for five minutes). If resting SpO<sub>2</sub> less than or equal to 95%, then do not proceed, evaluate patient for pulmonary pathology/abnormalities. Consult Pulmonary for evaluation.
- 2.** Have AC start exercise on a track/treadmill/elliptical/exercise bike. Once at a moderate exercise heart rate (HR 120-130), monitor SpO<sub>2</sub> and HR continuously (in 4 increments if on a track) for a total of 10 minutes of moderate exercise. An exertional SpO<sub>2</sub> decrease of 5% or more from resting baseline is a positive test needing Pulmonary or Cardiology evaluation.



# Reference: Modified Exercise Tolerance Test Steps

Aircrew (AC) require physical fitness that ensures optimum physiological margin in the flight environment. After a COVID-19 disease course of any duration, exercise tolerance can be reduced. Completing an exercise tolerance test (ETT) will evaluate AC for a return to their physical fitness level. If no treadmill is available or available treadmill does not incline to required grade (14%) then a variation of the Exercise Tolerance Test while monitoring SpO<sub>2</sub> and heart rate is a option. Optional modalities include: treadmill, elliptical, exercise bike, or running track.

## Modified Exercise Tolerance Test Instruction

1. Allow AC to sit and rest for five minutes. During this time, fasten a fingertip pulse oximeter to the patient for continuous monitoring. Use a nitrile glove or tape if necessary. If this is not practical, then intermittent monitoring as 4 increments during the test is an option.
2. Before starting ETT, screen AC for resting HR and resting SpO<sub>2</sub>. Document both.
  - ✦ If resting HR  $\geq 100$  or resting SpO<sub>2</sub>  $\leq 95\%$ , DO NOT CONTINUE TEST.
3. Have AC gradually increase exercise intensity on the modality of their choice until HR is 120-130 (moderate intensity exercise).
  - ✦ Ensure that increase in exercise intensity is slow and gradual. Remember that AC were recently ill and that residual symptoms of COVID-19 may be indolent.
  - ✦ Note that moderate intensity exercise is a somewhat hard perceived level of exertion (e.g., moderate level of hiking, walking while carrying a light load).
4. Monitor HR and SpO<sub>2</sub> for 10 minutes, continuously if possible, but preferably at two minute intervals.
  - ✦ Have AC increase/decrease exercise intensity to attempt to maintain a HR of 120-130.
  - ✦ If SpO<sub>2</sub> decreases  $\geq 5\%$  from the resting baseline during the test, STOP THE TEST, record the findings, and evaluate the AC pulmonary and cardiac function.
5. Once test is complete, document results in AERO in the following format: **“Modified ETT completed for 10 minutes. Resting SpO<sub>2</sub> xx%. Exertional SpO<sub>2</sub> xx%. Max HR xxx.”**



## Reference: NAMI Submission

AC recovered from a COVID-19 symptoms positive course may return to “Up” flight status by their local Flight Medicine Provider unless they were hospitalized for significant symptoms or complications. AC hospitalized require Naval Aerospace Medical Institute (NAMI) review of their post-COVID-19 evaluation prior to being issued an “Up” chit (DD 2992). Hospitalization only to obtain a COVID-19 test or other non-clinical indication does not constitute a hospitalized disease course. The next two slides guide through submission procedures to NAMI in the Aeromedical Electronic Resource Office (AERO)<sup>1</sup>.

### COVID-19 Evaluation Submission in AERO:

Recovery from a COVID-19 symptoms positive course can vary from immediate return of full physical capability or take weeks of gradual rehabilitation. Some physiological deficits can remain asymptomatic until the specific body system is stressed in flight. Evaluation by an Aerospace Medicine Provider is required to safely return AC back to “Up” flight status.

### Submission of the Medical Evaluation in AERO to NAMI requires the following:

- ✉ For all **Symptomatic Cases** a NAVMED 6410/10 “short form” flight physical is submitted to include exam focused on patient’s specific disease course and a complete Review of Systems with emphasis on the pulmonary, cardiac, vascular, neurologic, and renal systems.
- ✉ In **Additional Flight Surgeon Comments** block, document ECG with comparison to last “5 year” Flight Physical ECG, SpO2 value, Treadmill ETT result (completed >10 METS with SpO2 >95% and reaching >85% of predicted heart rate) or Modified ETT result (completed 10 minutes with SpO2 >95% and heart rate 120-130) and PFT or Spirometry results if required. If other tests or evaluations used document those as well. See example on slide 16.
- ✉ For **Hospitalized Cases** an Aeromedical Summary (AMS) documenting the COVID-19 course to include fever or symptoms start date, hospitalization dates, symptoms and duration, any remaining physical limitations or symptoms, and date of fever/symptoms resolution.
- ✉ **Document Uploads** include ECG, last prior ECG, any consults or labs obtained, and hospital discharge summary and PFT or Spirometry report as applicable.

<sup>1</sup> Aeromedical Electronic Resource Office [https://www.med.navy.mil/sites/nmotc/nami/arwg/pages/aeromedicalelectronicresourceoffice\(aero\).aspx](https://www.med.navy.mil/sites/nmotc/nami/arwg/pages/aeromedicalelectronicresourceoffice(aero).aspx)



## Reference: NAMI Submission

Contact NAMI when submitting a post-COVID-19 evaluation to fast track review and disposition.

NAMI Physical Expedite Request Email: [usn.pensacola.navmedotcnafe1.list.nami-physqualtech@mail.mil](mailto:usn.pensacola.navmedotcnafe1.list.nami-physqualtech@mail.mil)

Hospitalized AC submissions are priority review status at NAMI to ensure the quickest return to "Up" flight status. Non-hospitalized AC submissions are supportive and review local Flight Surgeon duty dispositions.

The diagnosis of COVID-19 is Not Considered Disqualifying (NCD). AC with persistent symptoms require NAMI review<sup>1</sup>. COVID protocols do not need to be included in yearly flight physical if previously submitted, or it has been >90 days since COVID-19 symptoms resolved.

### COVID-19 Evaluation Specific Submission:

To identify and code the flight physical and AMS submission as a COVID-19 evaluation, perform the following on the NAVMED 6410/10 and AMS.

 **NAVMED 6410/10:** In "Additional Flight Surgeon Comments" document disease course type as one of the following: COVID Outpatient Short Course, COVID Outpatient Long Course, or COVID Hospitalized. In ICD code column use **U07.1**. (See example below)

Additional Flight Surgeon Comments		
Comment	CD/ NCD	ICD code
COVID Outpatient Short Course or COVID Outpatient Long Course or COVID Hospitalized	NCD ▼	U07.1 
ECG: NSR at HR 62 SpO2: 98% Treadmill ETT: Completed >10 METS with SpO2 >95% and reached >85% of predicted heart rate.		
If required PFT: DLCO 80-120% of predicted		

 **AMS:** In "Disqualifying Conditions" list "COVID-19" as the number "1" diagnosis and use ICD-10 code "**U07.1**"

- ✦ List all other diagnoses that require a waiver submission and prior granted waivers
- ✦ Fill in complete evaluation findings and results of PFT, ECG comparison, and SpO<sub>2</sub>
- ✦ Blocks in the AMS marked as "see AHLTA or Flight Physical" will not be accepted.

<sup>1</sup> Manual of the Medical Department, NAVMED P-117, Chapter 15.





## Reference: Protocol Application Criteria Caveats

The following application criteria will answer how to apply this guideline and its protocols in cases where the AC have already recovered from COVID-19 but have **not** been evaluated prior to returning to the cockpit. The goal is to ensure the quickest return to “Up” flight status while still emphasizing AC safety. If AC are symptomatic or still limited in physical activity they shall see their FS as soon possible for medical evaluation. This criteria applies only to AC who fall into the below dates and categories. After the guideline policy implementation date, all AC must have an evaluation prior to returning to an “Up” flight status.

- 
**Aircrew (AC) COVID-19 cases before 18 AUG 2020:** Continue flying in an **Up status** unless symptomatic. If symptomatic still, then must have Flight Surgeon evaluation.
- 
**Non-TACAIR AC COVID-19 cases between 18 AUG – 17 NOV 2020:**
  -  Flown **1** flight since COVID-19 course: AC consultation with FS to review flight, disease course and determine if they need to follow protocols.
  -  Flown **≥ 2** flights: AC continue flying in an **Up status** and consultation with FS as soon as **practical** for COVID-19 course review.
- 
**TACAIR/Mask AC COVID-19 cases between 18 AUG – 17 NOV 2020 :**
  -  Flown **1** dynamic flight since COVID-19 course: AC consultation with FS to review flight. If no symptoms or physical limitation, continue flying in an **Up status**.
  -  Flown **≥ 2** dynamic flights: continue flying in an **Up status**.
- 
**All Navy and Marine Corps Class 1 & 2 AC COVID-19 cases after 17 NOV 2020:** When recovered from COVID-19, they are in a **down status** until protocol completed per guideline.
- 
**AC hospitalized for COVID-19 clinical indications:** Regardless of date, if not evaluated prior, must be evaluated per appropriate protocol regardless of when they recovered.
- 
**Note to Providers:** Any symptoms during a flight shall be treated as a Physiologic Episode per Naval Safety Center instructions. Consider COVID-19 protocols during FS evaluation.